UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	Kirk Charles Frederickson
Serial No.:	10/676,775
Filed:	October 1, 2003
Group Art Unit:	3682
Examiner:	Van Pelt, Bradley J.
Title:	HARMONIC FORCE GENERATOR FOR AN ACTIVE VIBRATION CONTROL SYSTEM

Commissioner for Patents
Mail Stop Appeal Brief-Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant submits this Appeal Brief pursuant to the Notice of Appeal filed April 15, 2010. The appeal brief fee has previously been paid. If the Commissioner believes that any additional fees or extensions are required, the Commissioner is authorized to charge Deposit Account No. 19-2189.

REAL PARTY IN INTEREST

The real party in interest is **Sikorsky Aircraft Corporation**, assignee of the present invention.

RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings which may directly affect or may be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1, 2, 4, 5, 31-36 stand pending, rejected and appealed.

Claims 3, 6, 7, 10-12, 14-18, 20-26 stand cancelled.

Claims 8, 9, 13, 19 and 27-30 stand withdrawn from consideration.

STATUS OF AMENDMENTS

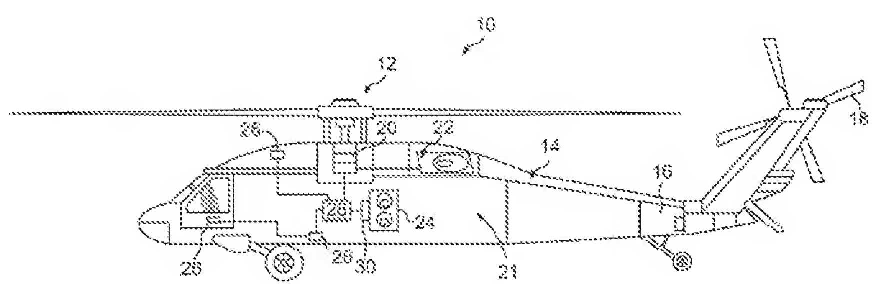
All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

The dominant source of vibration in a helicopter is that generated by the main rotor system at the blade passing frequency (rotation rate times the number of rotor blades). Forces and moments are transmitted usually through the transmission via fuselage attachments, to produce vibration in the fuselage. [¶2]

One conventional approach to reducing such vibration involves replacing a rigid gearbox mounting strut with a compliant strut and parallel hydraulic actuator. Another conventional approach utilizes force generators consisting of counter-rotating eccentric masses that rotate at the frequency of the primary aircraft vibration and generate a fixed magnitude vibration force. This system, although effective for direct gearbox mounting, requires a parasitic mass of considerable magnitude which may result in an unacceptable weight penalty. [¶¶3-4]

The present application relates to producing large, controllable, vibratory forces to compensate for sensed noise or vibrations, and more particularly to a force generator which is part of an active vibration control (AVC) system for an aircraft. [¶1]



In operation, vibratory forces are produced by the main rotor assembly 12 due, for example, to asymmetric air flow in forward flight. Such vibratory forces arising as the main rotor assembly 12 rotates are, in the absence of any compensating systems, transmitted from the rotor 12 to the fuselage 14. Operation of the force generator(s) 24 is continuously varied by the

processor 28 to cater to changing dynamic characteristics such that vibratory forces caused by the rotor assembly 12 and/or other vibratory sources are reduced or eliminated. [¶27]

Summary of Claim 1

Referring in particular to Figures 2A and 2B, claim 1 recites a processor that controls a power source to drive a crank such that a phase and magnitude of the vibratory inertial force is continuously varied to reduce an externally generated vibratory force sensed by a sensor system.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. 35 U.S.C. §103

1. Were claims 1, 2, 4, 5, 31, and 32 properly rejected under 35 U.S.C. §103(a) as being unpatentable over *Kanski*. (2309172) in view of *Maslov* (US 20050184689).

2. Were claims 33-36 properly rejected under 35 U.S.C. §103(a) as being unpatentable over *Kanski* in view of *Maslov* as applied to claim 1 and further in view of *Kotoulas* (20020117579).

ARGUMENT

A. 35 U.S.C. §103

1. Claims 1, 2, 4, 5, 31, and 32

Claims 1, 2, 4, 5, 31, and 32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Kanski*. (2309172) in view of *Maslov* (US 20050184689).

The Examiner admits that:

> In summary, Kanski teaches the invention as claimed except a processor and a sensor system in communication with the processor. See the Board decision on April 29, 2009.

Notably, the primary goal of *Kanski* is vibration generation for the treatment of granular materials.

> This invention relates to processing vibrating machines, such as screens, separating tables, conveyors and similar machines. Generally defined, the object of the present invention is to propose a simple apparatus by means of which it is possible to obtain a complex vibratory motion, substantially a combination of a simple gyratory vibration with a vibration produced by a mass center provided with a planetary motion.

[Col. 1, lines 1-9]

> The importance of application of vibration methods to the treatment of granular materials is well known. These methods are mainly applied for such operations as sizing, scalping and similar operations usually defined by screening. Another important application of these methods relates to the separation of bulk materials composed of particles having different physical properties such as specific gravity, surface characteristics, shape of the particles, etc. The action of the vibration in the aforementioned processes is extremely complex, and extensive research work made by many authors and by me shows that for a given material and setting of the machine firstly the geometrical and dynamical type of the vibrations to which the material is subjected have a fundamental importance in the results obtained; secondly, in many operations even the slightest changes in the type or direction of the vibration greatly influence the efficiency of the operation. In this respect it is obvious that a vibrating processing machine should be provided with as many adjustable characteristics as possible.

[Col. 2, lines 31-53]

The ***entire purpose and goal*** of *Kanski* is to generate vibration. The adjustable characteristics are to provide particular vibration treatment of the granular materials and no processor or sensor system is even required.

The Examiner relies upon *Maslov* as follows:

> Maslov teaches the processor (FIG. 21; ¶¶ 22, 42, 60, 72, 171, 240, 263, and 318) and the sensor system 62, 66, 45, 146, *etc.* (FIGS. 16 and 20; ¶¶ 170, 171, 239, 241, 244, 245, 258, and 259; claims 11, 22, and 33) in communication with the processor, wherein the processor controls the power source/motor (¶¶ 60 and 72) in order to, *inter alia*, continuously vary the phase and magnitude (¶¶ 266 and 286) of the force from the generator (¶¶ 187 and 314; claim 24). As noted, Maslov's force broadly includes the vibratory inertial force.

Maslov is directed only to adaptive electric motors which provide improved performance and efficiency. Thus, even if the *Maslov* electric motor was utilized to drive the vibrating processing machine of *Kanski*, the proposed combination would still be directed to a vibrating processing machine - perhaps with but greater adjustable characteristics than *Kanski* alone would otherwise provide. Nonetheless, the proposed combination would still generate vibration with adjustable characteristics as desired by *Kanski*.

Moreover, *Maslov* fails even to disclose or suggest a sensor system which can sense externally generated vibratory forces. Notably, all the sensors to which the Examiner refers as the *Maslov* sensor systems 62, 66, 45, 146, etc., are motor operation sensors which are internal to the electric motor itself.

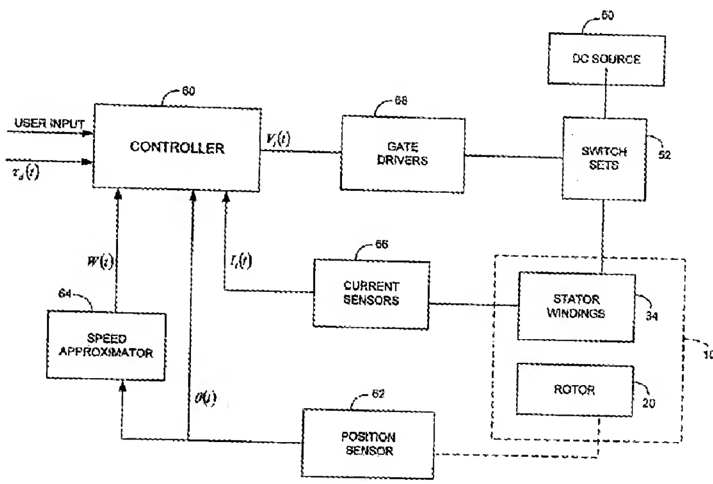


Figure 16

That is, the sensors of *Maslov* communicate only with internal motor components such as the stator windings 34 and the rotor 20 so as to sense operational parameters and control the electric motor itself.

> [0239] The controller **60** may respond to feedback signals received from a position sensor **62**, and also to a speed approximator **50**. Current in each phase winding **34** may be sensed by one of seven current sensors **66**, and the output for each phase winding may be provided to the controller **60**. A Hall-effect current sensor, such as F.W. Bell SM-15, may be used. In addition, the controller **60** may be able to receive various other inputs, as shown in **FIG. 12**.

> [0241] In the embodiment shown in **FIG. 16** the position sensor **62** is schematically represented by a single unit. Alternatively, several sensors may be appropriately positioned at stator sections along the air gap to detect rotor magnet rotation. The position sensor **62** may be any known magnetic sensing devices (such as Allegro Microsystems 92B5308 or another Hall effect device), a giant magneto resistive (MGR) sensor, a reed switch, a pulse wire sensor including an amorphous sensor, a resolver or an optical, magnetic, inductive or capacitive sensor.

The sensor system is therefore, even under the Examiner's interpretation, simply not operable to sense externally generated vibratory forces.

Appellant specifically claims:

<u>said processor controls said power source to drive said crank such that a phase and magnitude of the vibratory inertial force is continuously varied to **reduce an externally generated vibratory force sensed by said sensor system**</u>**.**

The proposed combination simply cannot teach this feature as the Examiner's proposed combination is not concerned whatsoever with externally generated vibratory forces sensed by a sensor system and certainly is not concerned with **reducing** such externally generated vibratory forces. Appellant respectfully requests reconsideration of this rejection for at least this reason.

Appellant respectfully submits that the Examiner's proposed combination – even if proper – fails to disclose or suggest Appellant's sensor system in any way as well.

2. **Claims 33-36**

Claims 33-36 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Kanski* in view of *Maslov* as applied to claim 1 and further in view of *Kotoulas* (20020117579).

As discussed above, the sensor system of *Maslov* is completely internal to the electric motor and concerned only with operations of the electric motor itself. There is simply no reason to locate an internal electric motor operation and control sensor system which controls operation of an electric motor as disclosed by *Maslov* to another area of an aircraft.

It is improper to modify the base reference in such a way that it ruins the goal or the function of the base reference. The following language is from MPEP 2143.01(V):

> If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation

to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

The Examiner's proposed modification would ruin the function of *Maslov* because the Examiner is essentially removing the sensor system from within the electric motor of *Maslov* which provides for the basic operation of the *Maslov* electric motor. This is improper. Appellant respectfully requests reconsideration of this rejection for at least this reason.

Simply, there is no motivation to combine the references as proposed by the Examiner other than following the knowledge disclosed within the present invention. That is, the Examiner is combining various components from a multiple of disparate references.

In fact, the Examiner's proposed combination actually undermines the principle goal and ruins the utility of the primary reference. This is impermissible usage of hindsight in an attempt to recreate Appellant's device. Appellant respectfully submits that the claims are properly allowable for at least this reason.

CONCLUSION

For the above reasons, the rejections by the Examiner should be reversed.

Respectfully Submitted,

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CLAIMS APPENDIX

1. A force generator comprising:

a rotationally fixed first circular member defined about a first axis to define a first inner diameter circular path, said first circular member having a first radius;

a second circular member defined about a second axis offset from said first axis to define a second radius;

a crank which mounts said second circular member, said crank rotatable about said first axis;

a mass located adjacent a circumference of said second circular member movable about a two-cusp hypocycloid path to generate a vibratory inertial force;

a processor;

a sensor system in communication with said processor; and

a power source which drives said crank, said processor controls said power source to drive said crank such that a phase and magnitude of the vibratory inertial force is continuously varied to reduce an externally generated vibratory force sensed by said sensor system.

2. The force generator as recited in claim 1, wherein said vibratory inertial force is a sinusoidal inertial force in a straight line.

4. The force generator as recited in claim 1, wherein said rotationally fixed first circular member comprises a ring gear.

5. The force generator as recited in claim 1, wherein said second circular member comprises a planet gear.

8. The force generator as recited in claim 1, further comprising an opposed circular counter member mounted to said crank about a third axis offset from said first axis.

9. The force generator as recited in claim 8, wherein said opposed circular counter member comprises a planet gear in meshed engagement with said first circular member.

13. A method of force generation for active vibration control in a rotary-wing aircraft comprising the steps of:

(1) defining a circular path within a rotationally fixed first circular member about a first axis, the first axis transverse to an axis of rotation of a main rotor assembly of the rotary-wing aircraft;

(2) defining a second circular member about a second axis offset from the first axis;

(3) locating a mass adjacent a circumference of the second circular member movable about a two-cusp hypocycloid path; and

(4) controlling movement of the second circular member about the circular path such that the second circular member simultaneously completes one revolution about the second axis and one orbit around said first axis to generate a vibratory inertial force to minimize a vibratory force from the main rotor assembly.

19. An active vibration control (AVC) system for a rotary-wing aircraft comprising:

a multitude of sensors located within a rotary-wing aircraft;

a controller in communication with said multitude of sensors;

a force generator comprising:

a rotationally fixed first circular member defined about a first axis to define a first inner diameter circular path, said first circular member having a first radius;

a second circular member defined about a second axis offset from said first axis to define a second radius, said second circular member movable about the circular path to simultaneously complete one revolution about said second axis and one orbit around said first axis;

a crank which mounts said second circular member, said crank rotatable about said first axis;

a mass located on said second circular member movable about a two-cusp hypocycloid path to generate a vibratory inertial force; and

a motor which drives said crank, said motor in communication with said controller to drive said crank to control a phase and magnitude of said vibratory inertial force in response to said processor.

27. The force generator as recited in claim 8, wherein said opposed circular counter member comprises a counterweight.

28. The force generator as recited in claim19, wherein said force generator is located within a fuselage of the rotary-wing aircraft.

29. A method as recited in claim 13, further comprising the step of:

(5) sensing a vibratory force from a main rotor assembly; and

(6) transmitting the vibratory inertia force of said step (4) through a fuselage to minimize the vibratory force sensed in said step (1).

30. A method as recited in claim 13, wherein said step (4) further comprises the step of:

(a) continuously varying the vibratory inertial force to a changing dynamic characteristic of the rotary-wing aircraft to minimize the vibratory forces sensed in said step (1).

31. The force generator as recited in claim 1, wherein said second radius is one-half the radius of said first radius, said second circular member movable about the circular path to simultaneously complete one revolution about said second axis and one orbit around said first axis

32. The force generator as recited in claim 1, wherein said power source is an electric motor.

33. The force generator as recited in claim 1, wherein at least one sensor of said sensor system is mounted in a cockpit area.

34. The force generator as recited in claim 1, wherein at least one sensor of said sensor system is mounted in a cabin area.

35. The force generator as recited in claim 1, wherein said sensor system generates signals representative of dynamic changes at selected locations as a main rotor assembly of a rotary wing aircraft rotates.

36. The force generator as recited in claim 35, wherein said phase and magnitude is continuously varied by said processor in response to changing dynamic characteristics in part caused by said rotor assembly.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings.

RELATED EVIDENCE APPENDIX

None.